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(54) FROZEN FOOD SUBSTANCE FROM EGG, ITS PRODUCTION AND APPARATUS THEREFOR

(71) We, CANADIAN PATENTS AND DEVELOPMENT LIMITED, a Company duly incorporated under the laws of the Parliament of Canada to which the Government Companies Operation Act applies, and having its head office in the City of Ottawa, Province of Ontario, Canada, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a frozen food substance from egg, its production and apparatus therefor.

Freezing of food substances, particularly eggs is quite a large industry in Canada, the U.S.A. and other parts of the world. Although it was first started about 1920, its growth has been quite phenomenal and the pack is at present about 20 million pounds in Canada and 500 millions pounds in the U.S.A.

This growth was due to the fact that half of the lay for the entire year, is produced from March to June inclusive. Storing surplus eggs in the shell at temperatures between 29° and 31°F. has been brought to a high degree of efficiency, yet deterioration does go on slowly — while, when hard frozen eggs can be held almost indefinitely without destructive changes. Also, the saving in storage space and transportation costs is substantial.

The growth during the past few years seems, however, to have levelled off due to what appears to be saturation of the markets. This saturation is due in great part to the form in which the eggs are frozen at present which limits the use of the frozen product to certain users, mostly bakeries.

At present the eggs are broken, the meats are separated from the shells and put into suitable mixers or "churns" that makes them into a homogeneous, thick, creamy mass. The separated meats are either "churned" directly if the whole egg is desired or are first separated into the two components, egg yolk and egg white before churning.

In either case, the churned egg mass is packed into 30 to 40 lb cans after the addition of sugar, salt or other additives. Under freezing conditions used commercially today, the eggs in these 30 to 40 lb. cans may be expected to become solidly frozen in about 36 to 72 hours. Depending on the initial microbial contaminations, many a can of egg is lost because the freeze is so slow that the core becomes sour before it congeals.

It is one object of the invention to provide a method of and apparatus for producing a frozen food egg substance, in which the freezing of the egg substance occurs sufficiently rapidly to substantially reduce any losses which may be incurred by the above mentioned process.

The quality of frozen egg is judged very largely by the number of viable bacteria which it contains. If the breaking stock is of good quality, the removal of the egg meat is done in clean fashion and the freezing is promptly accomplished, the bacterial count is comparable with that of well-handled raw milk. It is the aim of the breaker putting out a quality product to reduce the incidence of these organisms to a minimum. The industry has, therefore, adopted methods for the pasteurization of the egg after removal from the shells but before freezing, using conventional heat exchangers. Still, because of the very slow freezing time necessary at present, the bacteria remaining in the pasteurized eggs do multiply before complete freezing finally stops their activity.

It is a further object of the invention to provide a method of and apparatus for producing a frozen food egg substance which substantially reduces the bacteria present in the egg substance and which in some instances eliminates or minimizes the need for pasteurization of the egg substance.

Another great disadvantage of present practice is defrosting or thawing the 30 to 40 lb. container of frozen eggs. This usu-

ally requires two days, including tempering in suitable coolers at approximately 40°F, then placing containers in running water till the frozen eggs are thawed. Many bakeries place the frozen product under bake-ovens or in the warm atmosphere of the bakery for 24 to 36 hours before they are ready for use. This protracted thawing time allows bacteria still present in the frozen egg to multiply as the frozen mass is gradually defrosted. Deterioration of the product takes place, and its severity depends on the length of defrosting time and the bacterial content of the frozen egg mass.

Yet another object of the invention is to provide a frozen food substance and a method of and an apparatus for its production wherein the length of time for defrosting the substance is substantially reduced when compared with known types of frozen food egg substances.

As a rule, the egg white (albumen) defrosts first, and the yolk particles second. Too many bakeries, not realizing this fact, start to use the thawing product before it is completely defrosted taking liquid portions as they separate from the frozen mass. This results in many difficulties since the product should be completely defrosted and thoroughly mixed before use to get a uniform and typical egg composition.

A further object of the invention is to provide a frozen food egg substance and a method of and an apparatus for its production wherein the substance may be defrosted substantially uniformly through its mass.

Many bakers do not require 30 to 40 lbs. of frozen eggs per day, but once the product is defrosted it should be immediately used to prevent deteriorations. This causes many problems and influences the production costs of small bakeries.

Another object of the present invention is to provide a frozen food egg substance and a method of and an apparatus for its production wherein the substance is frozen in a discrete pellet form so that only a portion of the substance need be defrosted to suit the needs of the consumer.

Known frozen food egg substances now on the market limit the use of frozen eggs to bakeries, and even some of these find it somewhat wasteful. Restaurants and similar establishments that need to use small portions at a time find the present substances impractical to use.

Thus to summarize, the main disadvantage of known frozen egg substances is their very slow freezing and the very long time required to bring them from the frozen state to a useable form. The substance is sold in 30 to 40 lb. tins or plastic pails and forms a solid block of frozen mass when frozen. These blocks are very difficult to break if only a portion of the block is needed. In addition, when the whole block is needed it requires about 2 days to thaw before it can be used. During this long thawing time, the thawed portion is susceptible to deterioration due to bacterial growth. The thawed product must be used immediately upon completion of thawing or it deteriorates.

According to one aspect of the present invention there is provided a frozen food substance from egg, comprising free flowing, discrete pellets of said egg, within the size range 3mm to 7mm.

According to a second aspect of the present invention there is provided a method of producing a frozen food substance from egg, comprising causing egg to fall from at least one nozzle into direct contact with a non-toxic, liquified gas refrigerant at a temperature of below −150°F, the flow rate of egg from the or each nozzle being 1 to 5 lbs./hour so that the said egg enters said liquified gas refrigerant, from above the surface thereof, as discrete globules which are frozen therein to form pellets within the size range 3mm to 7mm, removing said pellets from said liquified gas refrigerant, allowing liquified gas refrigerant adhering to said pellets to evaporate while maintaining said pellets frozen, and storing said pellets in a frozen condition.

According to a third aspect of the present invention there is provided an apparatus for producing frozen food substance from egg, comprising a thermally insulated container, means for feeding a non-toxic, liquefied gas refrigerant to said container, means for feeding said egg through at least one nozzle thereof at a flow rate of 1 to 5 lbs./hour for the or each nozzle for said egg to fall into said liquefied gas refrigerant, from above the surface thereof, as discrete globules, and means for removing, from said container, frozen pellets formed from said discrete globules in said liquified gas refrigerant, the pellets being within the size range 3mm to 7mm.

The egg may comprise egg yolk, egg white or homogenized egg yolk and egg white.

When the egg product is homogenized egg yolk and egg white at least one additive selected from meat, onion, spices, salt, pepper, flour, sugar and shortening may be added to it.

Preferably the non-toxic, liquefied gas refrigerant is selected from liquefied nitrogen, helium, hydrogen or a fluorinated hydrocarbon.

In the preferred apparatus according to the present invention the means for feeding the egg comprises a peristaltic pump, and the means for removing the frozen pellets from the container comprises a screw conveyor.

Further in a preferred apparatus according to the present invention, means are pro-

vided for maintaining a predetermined level of the non-toxic, liquefied gas refrigerant in the container.

The accompanying drawing which illustrates, by way of example, an embodiment of the invention, is a partly sectioned side view of an apparatus for producing frozen food substance from egg.

In the drawing there is shown a thermally insulated container 1, means 2 in the form of a delivery pipe for feeding a non-toxic, liquefied gas refrigerant 4 to the container 1, means 6 for feeding egg to fall into the liquified gas refrigerant 4 as discrete globules 8, and means 10 for removing from the container 1, frozen pellets 12 formed from the discrete globules 8 in the liquified gas refrigerant 4.

The thermally insulated container 1 comprises a hopper shaped, closed topped, steel vessel 14 within an outer casing 16 and separated therefrom by asbestos, glass fibre or other thermal insulation 18. The container 1 has a sealed observation port 20, an egg inlet 22, an access opening 24 for the means 10, and a removal opening 26 for the frozen pellets 12. The means 2 for feeding a non-toxic, liquified gas refrigerant 4, in this instance liquid nitrogen, comprises a pipe extending through the walls of the vessel 14 and the casing 16 and the thermal insulation 18.

The egg inlet 22 has an elongated passage in plan view, and the means 6 for feeding egg to fall into the liquified gas refrigerant 4 as discrete globules 8, comprises a peristaltic pump 28 and a row of outlet nozzles 30 fitted thereto and extending into the elongated passage of the inlet 22. The inlet 22 extends into the container 1 to minimize freezing of the egg at the feeding means 6. The peristaltic pump 28 is of a known type which functions by flattening portions of flexible tubes 32 progressively in a lengthwise direction and is mounted on the casing 16 by means of a bracket 34. The outlet nozzles 30 are attached to the outlet ends 36 of the flexible tubes 32 of the peristaltic pump 28, and the inlet ends 38 of the flexible tubes 32 are connected to a cooler containing egg (not shown).

The means 10 for removing from the container 1, the frozen pellets 12 comprises a screw conveyor 40, a tubular casing 42 around the screw conveyor 40, and a collection tray 46 on a platform 48 in the removal opening 26. The lower end of the screw conveyor 40 is located at the lower end of the hopper-shaped vessel 14 to collect the frozen pellets 12.

A means for maintaining a predetermined level of the liquified gas refrigerant 4 in the container 1 comprises a liquid level switch 50, which operates a valve 52 in the delivery pipe 2.

In operation the apparatus is arranged as shown in the drawing, with the inlet ends 38 of the flexible tubes 32 connected to, for example, a cooler containing, for example, homogenized egg yolk and egg white, and the delivery pipe 2 connected to, for example, a source of liquid nitrogen. The container 1 is partially filled with liquified nitrogen 4, and the peristaltic pump 28 is started to cause the discrete globules 8 of the homogenized egg yolk and egg white to fall into the liquid nitrogen 4. The motor 44 is started to rotate the screw conveyor 40.

As the discrete globules 8 fall into direct contact with and enter the liquified nitrogen, which is at a temperature below −150°F, the discrete globules 8 are frozen to form frozen pellets 12. The frozen pellets 12 sink downwardly through the liquid nitrogen 4 towards the lower end of the screw conveyor 40, which carries them up the tubular casing 42 and deposits them in the collection tray 46. When a suitable quantity of frozen pellets 12 has collected in the collection tray 46, and liquified nitrogen adhering to the frozen pellets 12 has evaporated whilst maintaining them frozen, the collection tray 46 is removed and the frozen pellets 12 therein may be sealed in a plastic bag and stored in a freezer.

It was found, for example, that, using the experimental apparatus shown in the drawing, frozen pellets 12 having an approximate size range of 3mm to 7mm were obtained using nozzles 30 of about 1.5mm diameter bore, disposed with their outlet ends about 350mm above the level of the liquid nitrogen 4, and a flow rate of 1.5 lbs. per hour of homogenized egg yolk and egg white from each nozzle 30. Obviously for large scale commercial production these dimensions would be changed according to the size of equipment.

With the apparatus shown in the drawing it was found that the flow rate of homogenized egg yolk and egg white was within the range 1 lb. per nozzle 30 per hour to 5 lbs. per nozzle 30 per hour.

A fairly constant flow rate of homogenized egg yolk and egg white from the nozzles 30 was found to produce fairly uniform frozen pellets 12. However, it is within the scope of the present invention to vary the flow rate of homogenized egg yolk and egg white from the nozzles 30 to obtain a desired size range of pellets 12. This can be accomplished by either having different flow rates from one or more nozzles 30 relative to the others, or actually varying the flow rate from one or more of the nozzles 30.

Whilst liquified nitrogen has been used in the embodiment as the refrigerant, other liquified gases at a temperature of less than −150°F may be used, for example, different natural gases such as helium, hydrogen or

krypton may be used, or liquid nitrous oxide, or any other non-toxic, liquified gas refrigerant such as liquid fluorinated hydrocarbons, an example of which is dichlorodifluoromethane.

The frozen pellets 12 are preferably packed in polyethylene bags for easy storage, and stored at below 0°F, preferably at −10°F, in a frozen condition until required.

An advantage with the frozen pellets 12 over other known forms of frozen food is that the frozen pellets 12 remain fairly free flowing as long as they are kept frozen and, should the frozen pellets 12 tend to cake together, they can quite easily be broken apart by hand. The frozen pellets 12 occupy a fairly small space in a freezer where any economy in space is highly desirable. The frozen pellets 12, being free flowing can easily be scooped up and measured, for example, by weighing, according to the demand, and then the portion for immediate use can be left at room temperature say 68°F, at which the frozen pellets 12 thaw and are ready for use in approximately 15 minutes.

A surprising result with the frozen pellets 12 is that, even though they appear to be reasonably dense, they may if desired be added in a frozen condition to other ingredients, for example, frozen pellets 12 of homogenized egg yolk and egg white may be added in a frozen condition directly to flour, sugar and shortening and worked out in the same manner as fresh eggs. The frozen pellets 12 have been found to thaw quickly during the working out. Alternatively frozen pellets 12 of homogenized egg yolk and egg white may be transferred in the frozen condition to a frying pan and melted and fried to form an omelet with or without any of the usual additives that may be added to an omelet mix.

The frozen pellets may be packed in tins, pails or multi-walled bags, and may be stored indefinitely in commercial frozen storage facilities.

A further advantage with the process of the present invention is the high quality of the substance when melted from the frozen pellets 12: this is probably due to the more or less instantaneous freezing of the discrete globules in the liquified gas, which has been found to kill about 60% to 80% of the bacteria which was present in the discrete globules before freezing.

In view of the bacteria being killed in this manner in, for example, egg, the pasteurization step normally necessary in other freezing processes is either eliminated or minimized, and thus any change in the natural characteristics of the egg due to the influence of the heat of pasteurization is either prevented or minimized.

Frozen pellets of the invention have been tested by using them in the preparation of white cake, cream puffs, custard, mayonnaise and sponge cake. In each cake the performance of the frozen pellet form was compared with its fresh counterpart, and no difference whatsoever could be found by a panel of experts.

As already stated additives may be included in the frozen pellet form of egg yolk and egg white, such additives include meat, onion, spices, salt, pepper, flour, sugar and shortening. The supply of homogenized egg yolk and egg white to the nozzles 30 may be agitated to keep the additive or additives dispersed in the homogenized egg yolk and egg white.

In some embodiments the thermally insulated container 1 is closed to the atmosphere and pressurized to reduce the evaporation of the liquid gas refrigerant.

In some instances it may be found that an undue amount of liquefied gas refrigerant may be sealed in, say, a plastic bag with the frozen pellets and this may cause the bag to puff up when this liquefied gas refrigerant has evaporated

To overcome the plastic bag being puffed up by the evaporation of liquefied gas refrigerant it may be necessary to ensure that the bag is flattened or evacuated before sealing it.

In other embodiments the screw conveyor 40 is replaced by, for example, a bucket conpeyor, a belt conveyor or similar means of conveying the frozen pellets 12 out of the liquefied gas refrigerant.

Also, in other embodiments the peristaltic pump 28 is replaced by, for example, piston injectors, spinning disc feeders, or any of the well known devices from which the egg can be produced in globule form for dropping into the liquefied gas refrigerant.

British Patent Specification No. 1,264,439 describes and claims a frozen food substance comprising free flowing discrete, particles of egg or semi-liquid dairy product wherein each said particle is of pop-corn-like form, and also a method of producing a frozen food substance from egg or semi-liquid dairy product comprising causing the egg substance or semi-liquid dairy product to fall into the direct contact with a non-toxic, liquefied gas refrigerant from a compressed, liquefied gas source, said liquefied gas having a temperature below −150°F and a turbulent surface on to which said egg substance or semi-liquid dairy product falls to form frozen, free flowing, pop-corn-like discrete particles, removing said discrete particles from said liquefied gas allowing liquefied gas adhering to said particle to evaporate whilst maintaining said discrete particles frozen, and storing said particles in a frozen condition.

WHAT WE CLAIM IS:—

1. A method of producing a frozen food substance from egg, comprising causing egg to fall from at least one nozzle into direct contact with a non-toxic, liquified gas refrigerant at a temperature of below −150°F, the flow rate of egg from the or each nozzle being 1 to 5 lbs/hour so that the said egg enters said liquified gas refrigerant, from above the surface thereof, as discrete globules which are frozen therein to form pellets within the size range 3mm to 7mm, removing said pellets from said liquified gas refrigerant, allowing liquified gas refrigerant adhering to said pellets to evaporate whilst maintaining said pellets frozen, and storing said pellets in a frozen condition.

2. A method according to claim 1, wherein said non-toxic, liquified gas refrigerant is selected from the group liquified nitrogen, helium, hydrogen and a fluorinated hydrocarbon.

3. Apparatus for producing frozen food substance from egg, comprising a thermally insulated container, means for feeding a non-toxic, liquified gas refrigerant to said container, means for feeding said egg through at least one nozzle thereof at a flow rate of 1 to 5 lbs/hour for the or each nozzle for said egg to fall into said liquified gas refrigerant, from above the surface thereof, as discrete globules, and means for removing, from said container, frozen pellets formed from said discrete globules in said liquified gas refrigerant, the pellets being within the size range 3mm to 7mm.

4. Apparatus according to claim 3, wherein means are provided for maintaining a predetermined level of said non-toxic, liquified gas refrigerant in said container.

5. Apparatus according to claim 3, wherein an inlet for said egg is attached to and extends into said container, whereby freezing of said egg is minimized at said means for feeding said egg.

6. A frozen food substance from egg, comprising free flowing, discrete pellets of said egg, within the size range 3mm to 7mm.

7. A method according to claim 1 or claim 2, substantially as herein described.

8. Apparatus for producing frozen food substance from an egg, substantially as herein described with reference to and as illustrated by the accompanying drawing.

ABEL & IMRAY,
Chartered Patent Agents,
Northumberland House,
303—306 High Holborn,
London WC1V 7LH.

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1376972 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*